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U.S. Shoots for the Moon, This Time to Stay

By JEFFREY KLUGER Thursday, Jun. 18, 2009



The Lunar Reconnaissance Orbiter, top, and the Lunar Crater Observation and Sensing Satellite, lower, are scheduled to be launched together on a mission to the moon

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Say this for the U.S. space program: we may have spent the past 40 years mostly ignoring the moon, but when we go back, we go back with a bang. Later today — if weather conditions and hardware permit — NASA will launch its much anticipated and deeply imaginative Lunar Reconnaissance Orbiter (LRO), the first American spacecraft of any kind to make a lunar trip since 1999.

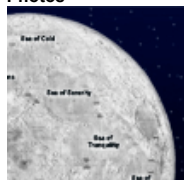
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In the past few years, the moon has once again become the hot place to go. Three countries with little spacefaring history — Japan, China and India — have all sent probes moonward since 2007, and China in particular has made it clear that it plans to return, first with more robot ships, then with astronauts.

In 2004, the U.S. restarted its own lunar program when President George W. Bush announced a new commitment to have astronauts back on the moon by 2020 and on Mars in the years after.

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scheduled to be mothballed by 2010, the space agency has committed itself to building and flying a lunar-capable manned ship by 2015, and though the Obama Administration is reconsidering the entire lunar program, so far it's still on track. The goal is to station astronauts on the moon for months, not days, to conduct lunar studies and as training for later attempts to live on Mars. As NASA knew in the 1950s, however, before you can send humans to the moon, you need to send robotic scouts. And that's where the LRO gets involved.

(Watch a video of the first broadcast from the moon.)

The 13-ft.-long, 2-ton spacecraft is not designed for a landing, but rather will settle into a low lunar orbit just 30 miles (48 km) above the surface, or about half the altitude at which the Apollos flew. The ship will be fairly stuffed with scientific instruments, one of the most important – if least sexy sounding – of which will be its laser altimeter. The altimeter will bounce laser beams off the lunar surface and, by measuring the speed at which they reflect back up, calculate the moon's topography to within inches. That's critical since long-term lunar stays require finding not only hospitable places to land, but also hospitable places to establish a home.

(See the space moon race.)

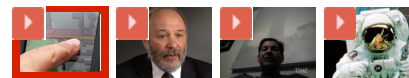
"We're going to measure the topography with the level of detail civil engineers need when they're building a building," says Jim Garvin, one of the lead developers of the LRO and the chief scientist at NASA's Goddard Space Flight Center, which will run the mission.

Just as important for choosing where to homestead is knowing the local weather – or at least the local temperature. Nobody pretends that the moon will be a thermally comfortable place to live, but few people realize just how punishing its climate extremes are – a torch-like 250 degrees Fahrenheit (120 Celsius) during the day and a paralyzing -382 Fahrenheit (-230 Celsius) at night. What's more, says Garvin, "the moon goes through this dance every 28 days." Those kinds of cycling extremes can be murder on hardware, and until we know more about the hot-cold rhythm, we can't build properly to withstand it.

(See the 50 highs and lows of space exploration.)

Easily the most exciting piece of hardware aboard the ship, however – for lay lunarphiles at least – will be the camera. Even the best reconnaissance photography before the Apollo visits missed things, which is why Apollo 11's landing almost came to grief when Neil Armstrong and Buzz Aldrin found themselves piloting their lander over an unexpected boulder field just seconds before touchdown. That's less likely to happen this time, thanks to a camera that can visualize objects as small as a few feet across. What's more, since the LRO will be in a polar orbit instead of an equatorial one – or, vertical rather than horizontal – the moon's 28-day rotation will eventually carry virtually every spot on the surface beneath the camera's lens.

"The moon will essentially walk around underneath the orbiter," says Garvin. "With the detail we get in the photographs, every picture will be like a mini-



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landing." That includes photos of the *Apollo* sites, all half-dozen of which should have their portraits snapped. If NASA gets lucky, Garvin believes the first such images could be in hand by the 40th anniversary of *Apollo 11*, on July 20.

For all of the LRO's versatility, one thing it can't do with much precision is look for water. That's a problem, since astronauts living on the surface will need plenty of the stuff, and bringing it all with them is out of the question. (A single pint of water weighs about a pound, and every pound you fly to the moon costs about \$50,000.) The LRO, however, will not be traveling alone. Launched on the same booster will be another entire spacecraft known as the Lunar Crater Observation and Sensing Satellite (LCROSS).

Shortly after the paired ships enter space, the LCROSS will separate from the LRO and embark on its own trajectory toward the moon. The LCROSS will lag behind, spending four months in a sweeping orbit that will carry it around both Earth and the moon; throughout its flight, it will remain attached to its upper stage rocket, separating from it only during its final approach to the moon. The rocket stage will then speed ahead, aiming for a deliberate crash in one of several craters in the south lunar pole in which the LRO's sensors will have detected signs of water ice. The collision will send a debris plume as high as 6.2 miles (10 km) into space and the LCROSS itself, trailing four minutes behind, will fly through it. As it does, its instruments will analyze the chemistry of the plume, looking particularly for water ice, hydrocarbons and other organics that will break down as they are exposed to their first flashes of sunlight in billions of years. Shortly after that, the LCROSS, too, will complete its suicide plunge, smashing into the ground just miles from the first impact site.

It will take about a year before the surviving LRO completes its more leisurely mission, and then another decade at least before humans are once again treading lunar soil. The LRO and LCROSS should play a big part in bringing that eventual return a little closer — and making it a lot safer.

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